Prediction Of Beef Fatty Acid Composition Using Near Infrared Spectroscopy: Effects Of Tissue And Sample Preparations

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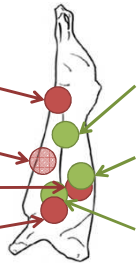
Objectives : Use a portable Near Infrared Spectroscopy (NIRS) equipment to evaluate

1 Performance of prediction of fatty acid (FA) composition on 7 different cattle tissues grinded in liquid nitrogen

4 muscles

- *Rectus abdominis* (RA)
- *Diaphragma* (Di)
- *Longissimus thoracis* (LT)
- *Infraspinatus* (In)



3 adipose tissues (AT)

- intercostal subcutaneous adipose tissue (ISAT)
- intermuscular fat of the 5th rib (IMF)
- shoulder subcutaneous adipose tissue (SSAT)

2 Effect of 5 different sample preparation methods on the performance of prediction of the FA composition on RA muscle

On carcass **(G0)** | Without grinding **(G0)** | minced **(G1)** | Knife mill grinding **(G2)** | Grinding in liquid nitrogen **(G3)**

➪ **To allow industries to guide early carcasses to the most appropriate marketing channels based on their FA composition, particularly their ω3 content.**

Materials and Methods

78 carcasses of cattle

- Milk or meat genetic type
- Young bulls, cows, oxen
- Diets based on grass or corn silage +/- extruded linseed supplementation

Calibration development

- Fatty acids profile (g.100g^{-1} of tissue) by GLC
- ASD Labspec 4 (350-2500 nm) portable spectrometer
- Spectra pretreatments (smoothing, derivation)
- PLS treatment and cross-validation

Calibration evaluation

R^2_{cv}

- Insuffisant : < 0.66
- Average : 0.66 – 0.81
- Good : 0.82 – 0.91
- Excellent : > 0.92

Results

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➢ For all AT, FA were not correctly predicted by NIRS (R^2_{CV} < 0.59)

➢ For muscles, predictions were quite satisfactory for major FA (C16:0, C18:0, C18:1 9c), total saturated (SFA) and monounsaturated FA (MUFA) (R^2_{CV} > 0.78)

➢ Polyunsaturated FA (PUFA) were poorly predicted by portable NIRS (R^2_{CV} < 0.53).

➢ Better prediction performances were obtained on the In muscle.

➢ However, in practice, to perform measurements on RA muscle seems preferable, as it is easily accessible in slaughterhouse.

Prediction models of FA (g/100g of tissue) by NIRS for the 7 ground tissues in liquid nitrogen (G3)

R^2_{CV}	Di	LT	RA	In	SSAT	ISAT	IMF
Total lipids	**0.85**	**0.81**	**0.93**	**0.92**	0.59	0.001	0.16
C16:0	**0.78**	**0.80**	**0.90**	**0.91**	0.51	0.13	0.001
C18:1 9c	**0.79**	**0.81**	**0.87**	**0.94**	0.41	0.20	0.12
SFA	**0.80**	**0.80**	**0.89**	**0.90**	0.55	0.19	0.12
MUFA	**0.80**	**0.82**	**0.89**	**0.93**	0.48	0.27	0.14
PUFA n-6	0.001	0.28	0.43	0.25	0.26	0.22	0.01
PUFA n-3	0.09	0.02	0.32	0.19	0.31	0.001	0.07
PUFA	0.03	0.26	0.53	0.21	0.32	0.09	0.05

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➢ Performance of FA predictions increased with the fineness of sample grinding, regardless the FA considered

➢ Predictions on C0, G0 and G1 samples were similar and unsatisfactory for most FA

➢ G2 and G3 grinding modes gave better results of prediction (R^2_{CV} < 0.80)

Prediction models of FA (g/100g of tissue) by NIRS on RA muscle depending on the grinding mode

R^2_{CV}	C0	G0	G1	G2	G3
Total lipids	0.65	0.64	0.61	**0.86**	**0.93**
C16:0	0.53	**0.68**	0.57	**0.81**	**0.90**
C18:1 9c	0.60	0.58	0.49	**0.80**	**0.87**
SFA	0.59	0.66	0.56	**0.82**	**0.89**
MUFA	0.64	0.60	0.53	**0.84**	**0.89**
PUFA n-6	0.45	0.37	0.09	0.47	0.43
PUFA n-3	0.22	0.47	0.47	0.26	0.32
PUFA	0.38	0.51	0.34	0.45	0.53

Conclusions

The portable NIRS has a significant potential for use to classify and orient carcasses on the basis of their FA composition. **The most appropriate tissue for the determination of the major FA is the RA muscle in its ground form** (knife mill type or grind in liquid nitrogen).

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